BIOTA AMAZÔNIA
OPEN JOURNAL SYSTEM

ARTICLE

DOI: http://dx.doi.org/10.18561/2179-5746/biotaamazonia.v5n3p78-82

Weight-length and Length-length relationships for 37 demersal fish species from the Marapanim River, northeastern coast of Pará State, Brazil

Daniel Ferraz[1] e Tommaso Giarrizzo[2]

1. Instituto Federal de Educação, Ciência e Tecnologia do Pará (IFPA), Departamento de Pesca e Aquicultura, Bairro do Marco, Belém, Pará, Brasil. E-mail: biopesq@gmail.com
2. Laboratório de Biologia Pesqueira e Manejo dos Recursos Aquáticos, Universidade Federal do Pará (UFPA), Terra Firme, Belém, Pará, Brasil. E-mail: tgiarrizzo@gmail.com

ABSTRACT: Length-length and weight-length relationships are presented for 37 demersal fish species caught in the main channel of the Marapanim River. The mean allometric coefficient (*b*) in the weight-length relationship ($W = aL^b$) was 3.04 (±0.32). Positive allometry was predominant (15 species, 42.1%), followed by isometry (13 species, 34.2%), and negative allometry (9 species, 23.7%). The present study represents the first reference of length-length relationships for the northern coast of Brazil.

Keywords: Demersal fishes; allometric coefficient; Marapanim; northern coast of Brazil.

Relações peso-comprimento e comprimento-comprimento para 37 espécies de peixes demersais do canal principal do Rio Marapanim, costa nordeste do estado do Pará, Brasil

RESUMO: Relações comprimento-comprimento e peso-comprimento são apresentadas para 37 espécies de peixes demersais capturadas no canal principal do rio Marapanim. O coeficiente alométrico (*b*) da relação peso-comprimento ($W = aL^b$) apresentou média de 3,04 (±0,32). A alometria positiva foi dominante (15 espécies, 42,1%), seguida por isometria (13 espécies, 34,2%) e alometria negativa (9 espécies, 23,7%). O presente estudo representa a primeira referência de relação comprimento-comprimento para costa norte do Brasil.

Palavras-chave: Peixes demersais, coeficiente alométrico, Marapanim, Costa norte do Brasil.

1. Introduction

Weight-length relationship is an important tool used in fish biology and stock assessment studies (ABDURAHIMAN et al., 2004). Such relationship allows the estimation of the fish weight using a particular length and may be applied to studies on gonadal development, feeding rate and maturity condition (LÊ CREN, 1951). Nevertheless, parameters in this relationship may vary temporally and/or spatially for a particular species, and require a regular update and estimation for each population separately (ISMEN et al., 2007). Intra-specific variations of the weight-length relationships may be substantial, depending on the period, the population, or the annual differences in environmental conditions (FROESE, 2006). In this context, the present study provides the length-length and weight-length relationships for 37 species of fishes from the subtidal zone of the main channel of the Marapanim River estuary, northern coast of Pará State.

2. Material and methods

Fish were collected in the estuary of Marapanim River, northeastern region of Pará State. This estuary is part of the Salgado region of Pará State, near the mouth of Pará River, approximately 160 km from the mouth of the Amazon River (Figure 1). Monthly samplings between August 2006 and July 2007 were carried out using a bottom trawl net with doors (model "Wing Trawl"). Tows occurred during daytime ebb tides at depths between 1.5 and 3.0 m. Specimens were identified to species level based on the pertinent literature. Measurements of total length (0.1 cm), standard length (0.1 cm) and total weight (0.01 g) were recorded.

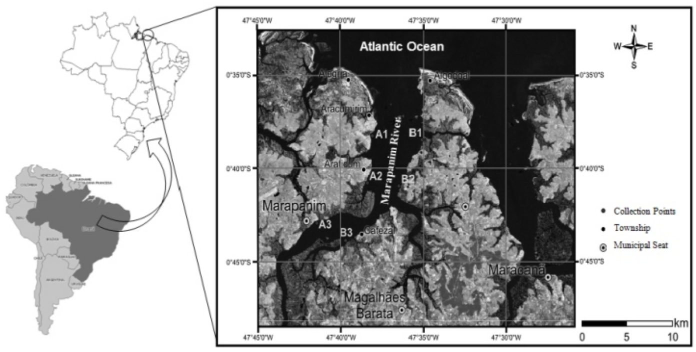

Figure 1. Marapanim River Estuary with alphanumeric codes indicating the fish sampling sites.

Length-length relationship was calculated using the equation $TL = a + bSL$, where TL is the total length (cm) and SL the standard length (cm). The weight-length relationship was calculated using the equation $W = aL^b$ (PAULY, 1984) with the data transformed into $\log W = \log a + b \log L$, where W is the fish weight (g) and L is the total length (cm). To test whether the value of b in the weight-length relationship was significantly different from the value of isometry ($b = 3$), the Student t-test was applied with a confidence level of ± 95% ($\alpha = 0.05$), according with Sokal and Rohlf (1987).

3. Results

A total of 19.886 specimens covering 17 families and 37 species was analyzed. Information regarding the species identification (Family and Species), length data, weight data and parameters of the relationships are shown in Table I (length-length relationships) and Table II (weight-length relationships). Sample size ranged from

Disponível em http://periodicos.unifap.br/index.php/biota
Submetido em 26 de Maio de 2015 / Aceito em 26 de Agosto de 2015

18 individuals for *Batrachoides surinamensis* to 8,904 individuals for *Cathorops spixii*. The mean (± standard error) total length ranged from 2.5 cm (± 0.16) for *Chaetodipetrus faber* to 15.4 cm (± 0.4) for *Macrodon ancylodon*. The mean total weight ranged from 0.56 g (± 0.02) for *Cloroschombrus chrysurus* to 78.6 g (± 19.6) for *Achirus Achirus*. For the weight-length relationships, twenty-one in 37 species showed r^2 higher than 0.95, whereas no species showed r^2 lower than 0.80. The allometric coefficient *b* showed a mean of 3.04 (± 0.32), with the lowest value for *Brachyplatystoma vaillantii* (1.78) and highest one for *Chaetodipterus faber* (3.66) (Figure 2). Among the species analyzed, 15 species showed positive allometry (42.1%), 13 species showed isometry (34.2%) and 9 species showed negative allometry (23.7%).

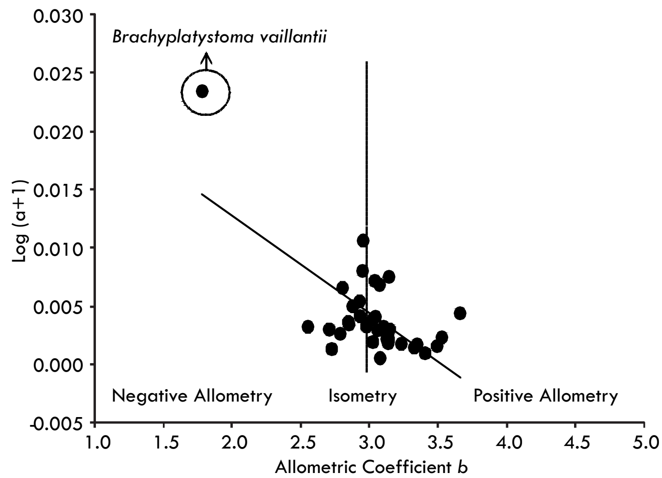

Figure 2. *Log* (a + 1) vs *b* of the weight-length relationships of 37 demersal fishes caught in the subtidal area of the main channel of Marapanim River, northeastern coast of Pará State, Brazil. The encircled point indicates an outlier.

Table I. Summary of the length-length relationship of 37 demersal fishes caught in the Marapanim River main channel, northeast of Pará State, Brazil. TL: total length; SL: standard length; n: number of individuals analyzed; a: regression constant b: correlation coefficient, r^2: coefficient of determination.

Family/Species	n	LLR Equation	Regression Parameters		
		TL = a + b SL	a	b	r^2
Achiridae					
Achirus achirus	49	y = 0.7999x – 0.2076	-0.208	0.800	0.996
Achirus lineatus	89	y = 0.7861x + 0.0265	0.027	0.786	0.980
Apionichthys dumerili	472	y = 0.805x - 0.0269	-0.027	0.805	0.957
Ariidae					
Bagre bagre	113	y = 0.7718x + 0.1904	0.190	0.772	0.988
Cathorops agassizii	127	y = 0.8235x - 0.0405	-0.041	0.823	0.984
Cathorops spixii	8903	y = 0.8163x + 0.0357	0.036	0.816	0.964
Aspistor quadriscutis	34	y = 0.8471x + 0.04	0.040	0.847	0.971
Aspredinidae					
Aspredinichthys tibicen	132	y = 0.9119x + 0.252	0.252	0.912	0.989
Aspredo aspredo	31	y = 0.9893x - 0.8256	-0.826	0.989	0.993
Auchenipteridae					
Pseudauchenipterus nodosus	413	y = 0.7605x + 0.2304	0.230	0.761	0.863
Batrachoididae					
Batrachoides surinamensis	18	y = 0.8691x - 0.1461	-0.146	0.869	0.992
Carangidae					
Cloroschombrus chrysurus	80	y = 0.7938x + 0.1463	0.146	0.794	0.947
Clupeidae					
Odontognathus mucronatus	1141	y = 0.8969x - 0.0304	-0.030	0.897	0.960
Rhinosardinia amazonica	39	y = 0.8059x + 0.1513	0.151	0.806	0.994
Cynoglossidae					
Symphurus plagusia	456	y = 0.9496x - 0.1821	-0.182	0.950	0.996
Engraulidae					
Anchoa spinifer	90	y = 0.8243x + 0.072	0.072	0.824	0.997
Anchoviella lepidentostole	34	y = 0.7875x + 0.2539	0.254	0.788	0.979
Lycengraulis grossidens	599	y = 0.8148x + 0.1212	0.121	0.815	0.983
Cetengraulis edentulus	39	y = 0.8106x + 0.1307	0.131	0.811	0.979
Ephippidae					
Chaetodipterus faber	49	y = 0.83x - 0.0598	-0.060	0.830	0.979
Gobiidae					
Gobioides broussonnetii	22	y = 0.7574x + 0.0439	0.044	0.757	0.974
Gobionellus oceanicus	77	y = 0.7337x + 0.0536	0.054	0.734	0.990
Haemulidae					
Genyatremus luteus	93	y = 0.8233x - 0.0725	-0.072	0.823	0.968
Mugilidae					
Mugil rubrioculus	19	y = 0.828x - 0.0066	-0.007	0.828	0.993
Paralichthyidae					
Citharichthys spilopterus	644	y = 0.8112x + 0.0132	0.013	0.811	0.991
Pimelodidae					
Brachyplatystoma vaillantii	379	y = 0.369x + 2.993	2.993	0.369	0.711
Pimelodus blochii	230	y = 0.7362x + 0.4774	0.477	0.736	0.910
Sciaenidae					
Cynoscion acoupa	37	y = 0.8308x - 0.3351	-0.335	0.831	0.986
Cynoscion leiarchus	434	y = 0.8076x - 0.0284	-0.028	0.808	0.980
Cynoscion microlepidotus	80	y = 0.8228x - 0.211	-0.211	0.823	0.995
Lonchurus lanceolathus	31	y = 0.7553x - 0.2439	-0.244	0.755	0.960
Macrodon ancylodon	128	y = 0.8268x - 0.4739	-0.474	0.827	0.985
Stellifer naso	238	y = 0.7865x - 0.0348	-0.035	0.786	0.967
Stellifer rastrifer	3922	y = 0.7605x - 0.0701	-0.070	0.760	0.933
Stellifer stellifer	322	y = 0.7368x + 0.1658	0.166	0.737	0.976
Tetraodontidae					
Colomesus psittacus	199	y = 0.827x - 0.1829	-0.183	0.827	0.995
Sphoeroides testudineus	18	y = 0.8109x - 0.076	-0.076	0.811	0.999

Table II. Summary of weight-length relationship describing length characteristics (cm), weight characteristics (g) and the parameters of weight-length relationship. TL min: minimum total length; TL max: maximum total length, SE: standard error; TW min: minimum total weight, TW max: maximum total weight; *a*: regression constant; *b*: correlation coefficient, r^2: coefficient of determination.

Family/Species	n	Length Characteristics				Weight Characteristics				WLR Parameters				
		TL min	TL max	Mean	±SE	TW min	TW max	Mean	±SE	a	b	r^2	±SE(b)	Allometry
Achiridae														
Achirus achirus	46	5.9	33	14.3	0.865	3.85	595.01	78.64	19.597	0.019	2.949	0.975	0.071	isometry
Achirus lineatus	89	3.3	17.9	8.7	0.322	0.56	95.9	17.48	2.024	0.016	3.074	0.928	0.092	isometry
Apionichthys dumerili	474	2.1	12.7	8.6	0.075	0.08	13.86	4.11	0.101	0.008	2.850	0.890	0.046	-
Ariidae														
Bagre bagre	113	6.2	18.3	9.8	0.292	1.11	41.24	7.49	0.750	0.004	3.136	0.979	0.044	+
Cathorops agassizii	127	3.5	16	7.8	0.241	0.25	27.6	4.9	0.488	0.008	2.978	0.961	0.054	isometry
Cathorops spixii	8904	0.7	17.3	7.7	0.017	0.04	39.15	4.27	0.036	0.009	3.027	0.915	0.013	+
Aspistor quadriscutis	35	8.1	13.9	10.3	0.256	4.06	22.3	9.19	0.757	0.006	3.135	0.965	0.105	isometry
Aspredinidae														
Aspredinichthys tibicen	135	3.8	17	11.5	0.189	0.09	7.32	2.67	0.121	0.003	2.725	0.930	0.065	-
Aspredo aspredo	35	5.7	20.5	13.9	0.555	0.25	14	5.13	0.555	0.001	3.079	0.993	0.045	+
Auchenipteridae														
Pseudauchenipterus nodosus	414	2.7	7.2	5.8	0.025	0.15	3.99	2.12	0.024	0.015	2.804	0.811	0.067	-
Batrachoididae														
Batrachoides surinamensis	18	2	17.2	8.1	0.959	0.03	58.85	10.38	3.508	0.004	3.492	0.990	0.087	+
Carangidae														
Cloroschombrus chrysurus	80	2.5	5.8	3.9	0.060	0.16	1.87	0.56	0.028	0.010	2.931	0.920	0.098	isometry
Clupeidae														
Odontognathus mucronatus	1141	2.7	13.9	7.6	0.054	0.09	12.28	2.03	0.048	0.007	2.708	0.913	0.025	-
Rhinosardinia amazonica	39	2.2	11	7.8	0.483	0.05	9.04	4.68	0.509	0.004	3.233	0.967	0.099	+
Cynoglossidae														
Symphurus plagusia	456	2.2	15.9	8.7	0.125	0.06	26.84	5.7	0.226	0.005	3.133	0.977	0.023	+
Engraulidae														
Anchoa spinifer	90	3.1	15.6	4.8	0.258	0.14	30.96	1.73	0.535	0.003	3.327	0.991	0.034	+
Anchoviella lepidentostole	34	2.7	6.8	5.6	0.157	0.18	2.73	1.51	0.097	0.008	2.983	0.983	0.070	isometry
Lycengraulis grossidens	599	1	13.2	4.1	0.067	0.01	19.37	0.8	0.063	0.009	2.846	0.890	0.041	-
Cetengraulis edentulus	33	3.8	12.1	8.9	0.461	0.3	15.85	8.02	0.785	0.004	3.347	0.983	0.079	+
Ephippidae														
Chaetodipterus faber	49	1.3	6.6	2.5	0.168	0.01	11.95	0.76	0.271	0.010	3.659	0.907	0.171	+
Gobiidae														
Gobioides broussonnetii	22	2.9	9.5	4.9	0.411	0.15	2.35	0.58	0.134	0.008	2.552	0.976	0.089	-
Gobionellus oceanicus	77	2.2	19.7	9.4	0.524	0.07	29.63	5.15	0.615	0.006	2.788	0.987	0.037	-
Haemulidae														
Genyatremus luteus	93	3.3	13.4	7.4	0.228	0.22	45.47	9.63	0.913	0.017	3.038	0.852	0.133	isometry
Mugilidae														
Mugil rubrioculus	19	2.6	9.2	4.5	0.404	0.11	9.21	1.78	0.603	0.005	3.529	0.921	0.250	+
Paralichthyidae														
Citharichthys spilopterus	645	1.3	14	4.9	0.105	0.01	28.68	2.45	0.177	0.007	3.148	0.970	0.022	+
Pimelodidae														
Brachyplatystoma vaillantii	385	3.2	24	13.6	0.142	0.39	17.23	6.04	0.106	0.056	1.781	0.812	0.044	-
Pimelodus blochii	230	7.9	19.2	15.3	0.091	3.06	53.92	29.5	0.512	0.007	3.060	0.846	0.087	isometry
Sciaenidae														
Cynoscion acoupa	37	4.1	25.2	10.5	0.810	0.38	90.84	14.05	3.103	0.005	3.126	0.993	0.044	+
Cynoscion leiarchus	434	1.5	14.4	4.1	0.083	0.01	34.88	1.17	0.142	0.012	2.879	0.877	0.052	-
Cynoscion microlepidotus	80	2	21.5	5.9	0.383	0.05	73.14	3.86	1.146	0.005	3.140	0.897	0.121	isometry
Lonchurus lanceolathus	31	3.9	20.7	14.2	0.789	0.35	52.28	18.12	2.432	0.005	3.025	0.964	0.109	isometry
Macrodon ancylodon	129	3	21.5	15.4	0.400	0.12	90.06	33.53	1.674	0.002	3.406	0.990	0.030	+
Stellifer naso	238	4.4	15.9	10.2	0.133	0.83	43.05	12.75	0.492	0.013	2.929	0.906	0.061	isometry
Stellifer rastrifer	3922	0.1	12.7	6.2	0.030	0.03	31.02	3.45	0.057	0.010	3.044	0.892	0.017	+
Stellifer stellifer	322	1.6	11.2	3.8	0.119	0.02	15.39	1.12	0.107	0.008	3.103	0.959	0.036	+
Tetraodontidae														
Colomesus psittacus	199	1.5	27.5	7.3	0.375	0.1	459.69	30.36	5.552	0.025	2.955	0.977	0.033	isometry
Sphoeroides testudineus	19	1.4	10.5	3.7	0.708	0.02	27.88	4.23	1.868	0.018	3.143	0.954	0.168	isometry

4. Discussion

According to Froese (2006), positive allometry ($b > 3$) suggests that large specimens have increased in height or width rather than in length, isometry ($b = 3$) indicates that small specimens in the sample have the same shape and condition of large specimens; negative allometry ($b < 3$) indicates that large specimens have changed the shape of the body to become more elongated specimens. Estuaries have high primary productivity, shelter and refuge areas against predators, natural nurseries for many species of fish and large availability of food (LAEGDSGAARD & JOHNSON, 1995, 2001; BARLETTA-BERGAN *et al.*, 2002a, b; BARLETTA *et al.*, 2003). Thus, it is expected that most of the species analyzed show isometry or positive allometry in their respective type of growth, which is due to the vast availability of food provided by the habitat.

The linear relationship resulting from the weight-length relationship between *Log (a +1)* vs *b* can be used to identify possible outliers in the sample (FROESE, 2000; STERGIOU & MOUTOPOULOUS, 2001) (Figure 2). Most species (91.9%) showed *b* values distributed between 2.5 and 3.5. According to Ricker (1975), values of *b* outside this range are considered atypical. Only *B. vaillantii* ($b = 1.78$) was below this range, and *C. faber* ($b = 3.66$) and *Mugil rubrioculus* ($b = 3.51$) were both above this range (Figure 2) in the estuary of Marapanim River.

In a study carried out in the intertidal creeks of Curuçá Estuary, northeastern coast of Pará State, approximately 20 km from the Marapanim Estuary, Giarrizzo et al. (2006) analyzed 40 species of fishes. Our estimates of *b* were lower than those of Giarrizzo et al. (2006) for 10 species and higher for eight species (Table III). Most of the species analyzed by Giarrizzo et al. (2006) showed a positive allometric growth (21 species), which corroborate with the present study. This result may be associated with the typical ichthyofauna of estuarine habitats, with high numbers of juvenile or small adults that inhabit environments with high food availability. Joyeux et al. (2008) in a study conducted along the Brazilian coast have found *b* values to be higher than in the present study for most of the species (Figure 3; Table III). Only species caught in the estuary of Curuçá River were compared with the present study and those from other regions were not considered. The latter study showed identical sampling methodology with the present study, and used trawl nets of the same length and mesh-size. Such procedure allowed a more efficient comparison by removing the effect of the variability of the estimates of *b*, which could be attributed to differences in the gear and the selectivity of the net. Of the 28 species in both studies, for only six species our estimates of *b* were higher than those found by Joyeux et al. (2008).

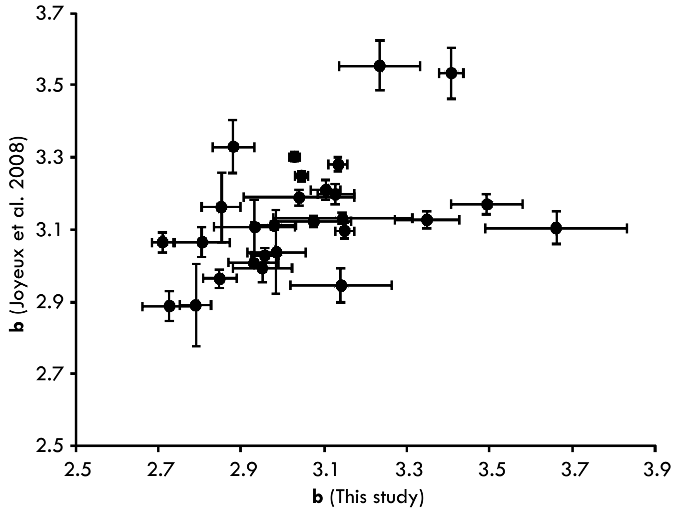

Figure 3. *b* (JOYEUX et al., 2008) vs *b* (this study) of the 28 species present in both studies for comparison between the two areas (Curuçá River Estuary and Marapanim River Estuary) of the northeastern coast of Pará State.

Table III. Table of comparison between the present study and other studies carried out on the northeastern coast of the state of Pará, Salgado micro-region of Pará State. n: number of individuals analyzed; TL min: minimum total length; TL max: maximum total length; b: allometric coefficient of the regression, SE: standard error of the allometric coefficient b; r^2: coefficient of determination.

Family/Species	This Study					Joyeux *et al.* (2008)					Giarrizzo *et al.* (2006)				
	n	TL min	TL max	b ± SE	r^2	n	TL min	TL max	b ± SE	r^2	n	TL min	TL max	b ± SE	r^2
Achiridae															
Achirus achirus	46	5.9	33	2.949 ± 0.071	0.975	64	3.7	31.3	2.995 ± 0.040	0.989	---	---	---	---	---
Achirus lineatus	89	3.3	17.9	3.074 ± 0.092	0.928	539	2.4	33.1	3.124 ± 0.016	0.985	50	3.7	16	3.36 ± 0.072	0.978
Apionichthys dumerili	474	2.1	12.7	2.85 ± 0.046	0.890	33	3.9	13.1	3.164 ± 0.097	0.972	---	---	---	---	---
Ariidae															
Cathorops agassizii	127	3.5	16	2.978 ± 0.054	0.961	2138	2.8	22.6	3.113 ± 0.011	0.975	388	6.2	22.5	3.08 ± 0.033	0.957
Cathorops spixii	8904	0.7	17.3	3.027 ± 0.013	0.915	2407	3.1	20.7	3.304 ± 0.013	0.965	22	11.3	19	3.23 ± 0.115	0.975
Aspredinidae															
Aspredinichthys tibicen	135	3.8	17	2.725 ± 0.065	0.930	116	3.1	24.3	2.890 ± 0.041	0.977	---	---	---	---	---
Auchenipteridae															
Pseudauchenipterus nodosus	414	2.7	7.2	2.804 ± 0.067	0.811	102	2.8	11.7	3.067 ± 0.042	0.982	53	7.8	11.2	3.05 ± 0.148	0.892
Batrachoididae															
Batrachoides surinamensis	18	2	17.2	3.492 ± 0.087	0.990	84	2.1	29.8	3.172 ± 0.028	0.993	15	8.9	37.8	3.47 ± 0.085	0.992
Carangidae															
Cloroschombrus chrysurus	80	2.5	5.8	2.931 ± 0.098	0.920	46	3	8.4	3.109 ± 0.074	0.976	---	---	---	---	---
Clupeidae															
Odontognathus mucronatus	1141	2.7	13.9	2.708 ± 0.025	0.913	501	2.5	15	3.067 ± 0.027	0.963	---	---	---	---	---
Rhinosardinia amazonica	39	2.2	11	3.233 ± 0.099	0.967	112	3	8.9	3.556 ± 0.069	0.96	1093	2.2	10.5	3.03 ± 0.021	0.952
Cynoglossidae															
Symphurus plagusia	456	2.2	15.9	3.133 ± 0.023	0.977	420	2.5	17.5	3.282 ± 0.020	0.984	---	---	---	---	---
Engraulidae															
Anchoviella lepidentostole	34	2.7	6.8	2.983 ± 0.070	0.983	20	3.6	10.9	3.039 ± 0.116	0.974	193	2	13.1	3.11 ± 0.030	0.983
Lycengraulis grossidens	599	1	13.2	2.846 ± 0.041	0.890	570	3	10.2	2.966 ± 0.025	0.96	434	2.8	18.2	2.97 ± 0.033	0.95
Cetengraulis edentulus	33	3.8	12.1	3.347 ± 0.079	0.983	944	4.4	13.1	3.129 ± 0.023	0.952	2424	2.8	18.2	3.48 ± 0.011	0.976

Table III. Continued.

Family/Species	This Study					Joyeux *et al.* (2008)					Giarrizzo *et al.* (2006)				
	n	TL min	TL max	b ± SE	r^2	n	TL min	TL max	b ± SE	r^2	n	TL min	TL max	b ± SE	r^2
Ephippidae															
Chaetodipterus faber	49	1.3	6.6	3.659 ± 0.171	0.907	70	2.3	13	3.106 ± 0.045	0.986	---	---	---	---	---
Gobiidae															
Gobionellus oceanicus	77	2.2	19.7	2.788 ± 0.037	0.987	23	2.3	17.4	2.892 ± 0.113	0.969	---	---	---	---	---
Haemulidae															
Genyatremus luteus	93	3.3	13.4	3.038 ± 0.133	0.852	746	2	18.8	3.191 ± 0.021	0.967	714	3.8	24.9	2.86 ± 0.015	0.98
Mugilidae															
Mugil rubrioculus	19	2.6	9.2	3.529 ± 0.250	0.921	---	---	---	---	---	456	3.6	23.5	2.90 ± 0.014	0.99
Paralichthyidae															
Citharichthys spilopterus	645	1.3	14	3.148 ± 0.022	0.970	239	2.1	15.3	3.099 ± 0.021	0.989	40	2.7	9.8	2.95 ± 0.054	0.988
Sciaenidae															
Cynoscion acoupa	37	4.1	25.2	3.126 ± 0.044	0.993	77	2.4	28.2	3.200 ± 0.027	0.995	131	4.9	27	2.99 ± 0.025	0.991
Cynoscion leiarchus	434	1.5	14.4	2.879 ± 0.052	0.877	47	2.2	16.8	3.332 ± 0.073	0.979	---	---	---	---	---
Cynoscion microlepidotus	80	2	21.5	3.14 ± 0.121	0.897	28	2	28.4	2.947 ± 0.046	0.994	---	---	---	---	---
Macrodon ancylodon	129	3	21.5	3.406 ± 0.030	0.990	52	10.5	25.6	3.536 ± 0.072	0.98	---	---	---	---	---
Stellifer naso	238	4.4	15.9	2.929 ± 0.061	0.906	3430	2	17.8	3.009 ± 0.007	0.983	350	5.7	20	3.28 ± 0.030	0.971
Stellifer rastrifer	3922	0.1	12.7	3.044 ± 0.017	0.892	3563	2	14.9	3.251 ± 0.014	0.937	24	2.7	14.1	3.40 ± 0.101	0.981
Stellifer stellifer	322	1.6	11.2	3.103 ± 0.036	0.959	1810	2	12.4	3.212 ± 0.027	0.887	14	3	14.6	3.46 ± 0.197	0.963
Tetraodontidae															
Colomesus psittacus	199	1.5	27.5	2.955 ± 0.033	0.977	387	2	28.2	3.030 ± 0.020	0.984	787	4.4	29.3	2.91 ± 0.014	0.982
Sphoeroides testudineus	19	1.4	10.5	3.143 ± 0.168	0.954	302	2	17.6	3.132 ± 0.015	0.993	236	2.2	18.3	2.71 ± 0.044	0.942

The observed differences can be explained by a number of factors including food availability, number of specimens and variations in the length range of the populations sampled (PAULY, 1984; WEATHERLEY & GILL, 1987). For Giarrizzo and Krumme (2006), the morphology of the estuary mouth and the proximity to the plume of the Amazon River are important factors that influence the estuarine ichthyofauna in northern Brazil. The estuary of Marapanim River is located approximately 160 km away from the mouth of the Amazon River, while the estuary of Curuçá River is located approximately 20 km closer. In addition to the larger area of mangrove cover, the proximity between the Curuçá River estuary and the mouth of the Amazon River may provide higher nutrient input to the estuary, allowing greater availability of food for the fishes compared with the estuary of Marapanim River. According to Tesch (1971), biological factors typical of the species are also relevant, such as growth phase, degree of stomach fullness, gonad maturity, sex, length frequency, health, and conservation techniques. In this regard, any comparison involving length-length or weight-length relationships should be analyzed with caution, as many factors may contribute to the great variability observed.

The results shown in this study represent the first reference of length-length relationship for the northern coast of Brazil and may contribute to a better assessment of fish stocks in estuarine areas.

5. Acknowledgements

The authors thank C. Cristina, R. Romero, E. Borcen, F. Seabra and J. Bastos for their assistance collecting the specimens, carrying out the biometry and entering the data. To B. Almeida for assistance collecting and identifying the specimens. This work is part of the Universal/2006 project funded by CNPq.

6. References

ABDURAHIMAN, K. P., HARISHNAYAK, T., ZACHARIA, P. U.; MOHAMED, K.S. Length-weight relationship of commercially important marine fishes and shellfishes of the southern coast of Karnataka, Índia. **NAGA, Worldfish Center Quarterly** Vol. 27 No. 1 & 2 Jan-Jun, 9-14, 2004.

BARLETTA, M., BARLETTA-BERGAN, A., SAINT-PAUL, U.; HUBOLD, G. Seasonal changes in density, biomass, and diversity of estuarine fishes in tidal mangrove creeks of the lower Caeté Estuary (northern Brazilian coast, east Amazon). **Marine Ecology Progress Series,** 256: 217-228, 2003.

BARLETTA-BERGAN, A., BARLETTA, M.; SAINT-PAUL, U. Structure and seasonal dynamics of larval fish in the Caeté River Estuary in North Brazil. **Estuarine, Coastal and Shelf Science,** 54: 193-206, 2002a.

BARLETTA-BERGAN, A., BARLETTA, M.; SAINT-PAUL, U. Community structure and temporal variability of ichthyoplankton in North Brazilian mangrove creecks. **Journal of Fish Biology,** 61 (Suppl. A): 33-51, 2002b.

FROESE, R. 2000. Evaluation length-weight relationships. In: FishBase: concepts, design and data sources. R. Froese and D. Pauly (Eds). ICLARM, Los Bauos, Laguna, Philippines. 133 pp, 2000.

FROESE, R. Cube law, condition factor and weight-length relationships: history, meta-analysis and recommendations. **Journal of Applied Ichthyology,** 22: 241-253, 2006.

GIARRIZZO, T.; KRUMME, U. Do four intertidal mangrove creeks in a homogenous salinity zone have the same habitat value for juvenile fish assemblages? In: **First international symposium on Mangroves as fish habitat, 2006.** Proceedings of first international Symposium on Mangroves as fish habitat, 2006.

GIARRIZZO, T., SILVA DE JESUS, A. J., LAMEIRA, E. C., ARAÚJO DE ALMEIDA, J. B., ISAAC, V.; SAINT-PAUL, U. Weight-length relationships for intertidal fish fauna in a mangrove estuary in Northern Brazil. **Journal of Applied Ichthyology,** 22: 325-327, 2007.

ISMEN, A., OZEN, O., ALTINAGAC, U., OZEKINCI, U.; AYAZ, A. Weight-length relationships of 63 fish species in Saros Bay, Turkey. **Journal of Applied Ichthyology,** 1-2, 2006.

JOYEUX, J. C., GIARRIZZO, T., MACIEIRA, R. M., SPACH, H. L.; VASKE JR. T. Length-weigth relationships for Brazilian estuarine fishes along a latitudinal gradient. **Journal of Applied Ichthyology,** 1-6, 2008.

LAEGDSGAARD, P.; JOHNSON, C. R. Mangrove habitats as nurseries: unique assemblages of juvenile fish in subtropical mangroves in eastern Australia. **Marine Ecology Progress series,** 126: 67-81, 1995.

LAEGDSGAARD, P.; JOHNSON, C. R. Why do juvenile fish utilise mangrove habitats? **Journal of Experimental Marine Biology and Ecology,** 257: 229-253, 2001.

LE CREN, C. P. Length-weight relationship and seasonal cycle in gonad weight and condition in the Perch (Perca fluviatilis). **Journal of Animal Ecology,** 20(2): 201-219, 1951.

PAULY, D. Fish population dynamics in tropical waters: a manual for use with programmable calculators. **ICLARM Studies and Reviews 8.** ICLARM, Manila, Philippines. 325 pp, 1984.

RICKER, W. E. Computation and interpretation of biological statistics of fish populations. **Bulletin of Fisheries Research Board of Canada,** 191: 1-382, 1975.

STERGIOU, K. I.; MOUTOPOULOS, D. K. A review of length-weight relationships of fishes from Greek marine waters. **Naga, ICLARM Quart,** 24: 1-39, 2001.

TESCH, F. W. Age and growth. In: Methods for Assessment of Fish production in Fresh Waters. W. E. Ricker (Ed.), **Blackwell Scientific Publications,** Oxford. 99-130 pp, 1971.

WEATHERLEY, A. H. & GILL, H. S. **The Biology of fish growth.** Academic Press, London, 1987.